**Project Proposal: Supervisory Control And Data Acquisition (SCADA) System Development for Launch Pad Oversight at the Virginia Spaceport Authority (VSA)**

**Abstract:** As VSA continues to expand operations by bringing new launch pads and processing facilities online, it is crucial to develop a Supervisory Control and Data Acquisition (SCADA) system that provides a unified architecture for all facilities. This SCADA system will serve as a common interface for independent control systems, offering full visibility, data logging, and manipulation capabilities across all sites. The project will involve the development of system architecture, networking, and graphical user interfaces (GUIs) for data visibility and control.

**Goal:** Students will be responsible for developing a SCADA system to support one launch pad. The project will involve building a graphical user interface (UI), mapping the UI to specific inputs and outputs (I/O), developing SCADA architecture, and ensuring reliable communication between the SCADA system and the launch pad using Ethernet/IP. By the end of the project, the simulated launch pad should be fully operational with SCADA support.

**Project Breakdown:**

**1. Network Topology for a Single Site:**

* **Objective:** Design a robust network topology for the launch pad that ensures reliable communication and data flow.
* **Tasks:**
  + **a. Design Architecture:** Determine the best network architecture (e.g., star topology) to support the SCADA system for the launch pad.
  + **b. Coordination with IT Department:**
    - Develop detailed network diagrams and specify hardware requirements.
    - Create a Bill of Materials (BOM) and cable routing map.
* **Expected Outcomes:**
  + A comprehensive network design tailored to the launch pad.
  + A detailed implementation plan, including BOM and routing maps.

**2. Server Configuration for Launch Pad SCADA:**

* **Objective:** Set up a dedicated server environment to support SCADA operations for the launch pad.
* **Tasks:**
  + **a. Virtual Machine Configuration:**
    - Develop and configure virtual machines for SCADA operations, including primary and backup systems.
  + **b. Communication Port Configuration:**
    - Allocate communication ports for I/O data and client station interfaces to support SCADA functionality.
* **Expected Outcomes:**
  + A fully configured SCADA server environment capable of managing the launch pad.
  + Optimized communication pathways for reliable data transmission.

**3. Site Control System Interfacing:**

* **Objective:** Establish communication between the launch pad’s control systems and the SCADA system.
* **Tasks:**
  + **a. Collaboration with Site Experts:** Work closely with launch pad control system experts to ensure seamless integration into the SCADA system.
* **Expected Outcomes:**
  + Successful data communication between the SCADA system and the launch pad control systems.
  + Documentation of the interfacing protocols used.

**4. SCADA UI/UX Development:**

* **Objective:** Develop a user-friendly and effective GUI for monitoring and controlling the launch pad operations.
* **Tasks:**
  + **a. GUI Development:** Utilize industry-standard software tools to design and build intuitive GUIs for data visualization and control.
  + **b. User Experience Optimization:** Ensure the UI is user-friendly and provides clear visibility of system status and controls.
* **Expected Outcomes:**
  + A functional and user-friendly SCADA interface for launch pad operators.
  + Aesthetic and intuitive design that enhances user experience.

**5. Testing and Validation:**

* **Objective:** Ensure the SCADA system operates reliably for the launch pad before deployment.
* **Tasks:**
  + **a. System Testing:** Conduct thorough testing of the SCADA system in a controlled environment.
  + **b. Validation:** Validate that all components (network, servers, UI) function correctly and meet the operational requirements of the launch pad.
* **Expected Outcomes:**
  + A validated SCADA system ready for operational use at the launch pad.
  + Documentation of test cases, results, and any necessary adjustments.

**Project Timeline:**

**First Semester (September 2025 - December 2025):**

* **September 2025:**
  + Initial project briefing and review of engineering documentation.
  + Formation of student teams and assignment of specific tasks.
  + Begin designing the network topology for the launch pad.
  + Start coordination with the IT department for network architecture.
* **October 2025:**
  + Finalize network design, including network diagrams, hardware requirements, BOM, and cable routing maps.
  + Begin server configuration, including setting up virtual machines and communication ports.
* **November 2025:**
  + Complete server configuration tasks.
  + Begin SCADA UI/UX development, focusing on GUI design.
* **December 2025:**
  + Finalize SCADA UI/UX development.
  + Conduct initial system testing and prepare for interfacing with the site control system.

**Second Semester (January 2026 - April 2026):**

* **January 2026:**
  + Complete site control system interfacing with the SCADA system.
  + Conduct comprehensive system testing and validation.
* **February 2026:**
  + Perform final adjustments based on testing results.
  + Continue optimization of SCADA GUI and system performance.
* **March 2026:**
  + Prepare final system validation and deployment at the launch pad.
  + Finalize all project documentation.
* **April 2026:**
  + Deploy the SCADA system at the launch pad.
  + Present the completed project, including system performance demonstrations and future scalability plans.

**Scalability and Future Expansion:** If the SCADA system successfully manages the launch pad operations, the modular design can be scaled to support additional sites. The network architecture, server configuration, and UI/UX design principles developed in this project will provide a strong foundation for future expansion. Ethernet/IP communication will allow for seamless integration of new control systems as the company grows.

**Conclusion:** This project will provide students with practical experience in SCADA system development, focusing on one launch pad. By the end of the project in April 2026, the simulated launch pad should be fully operational with SCADA support, laying the groundwork for potential scalability to additional sites.